July 5, 1966 R. METAILLER 3,259,259

EASY CONTROL LOADER

Filed March 1, 1965 2 Sheets-Sheet 1

Fig.2.

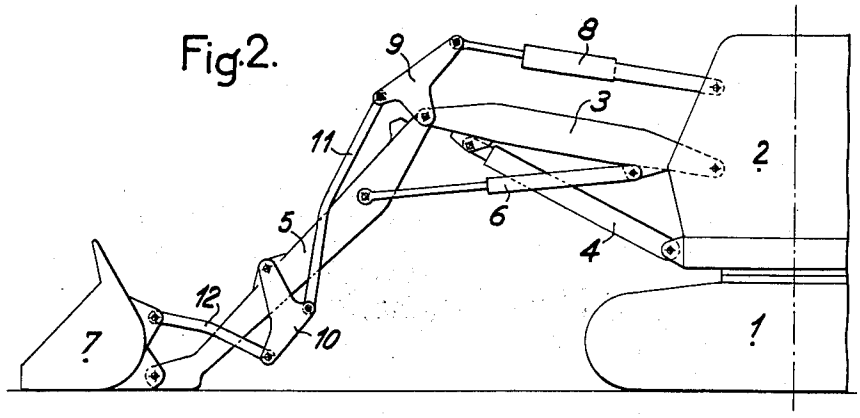


Fig.3.

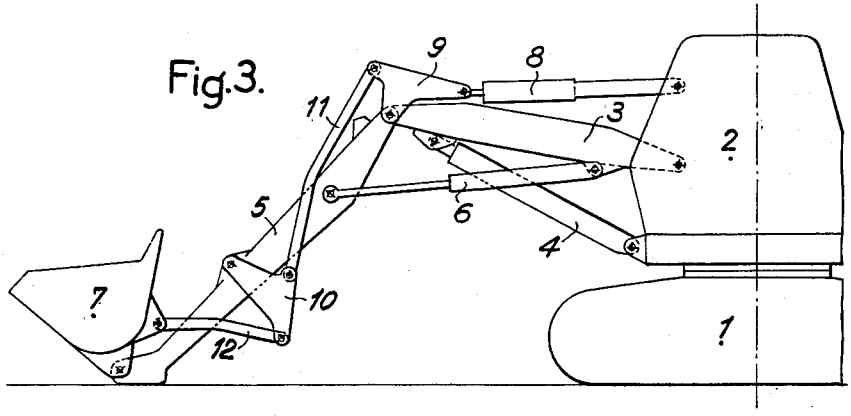
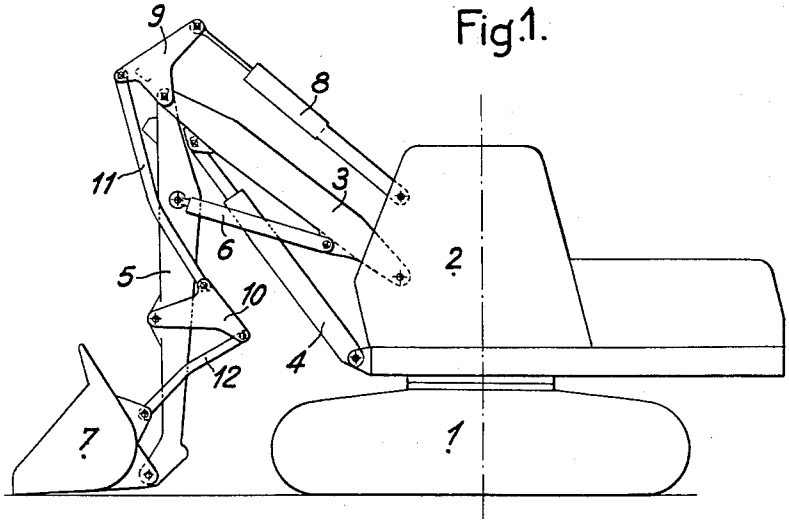


Fig.1.



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Fig.4.

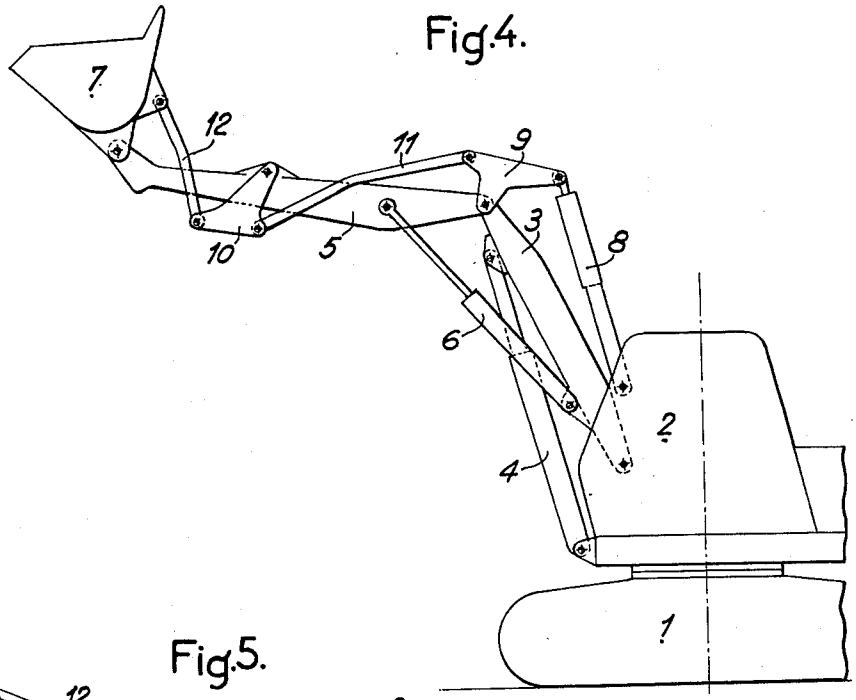
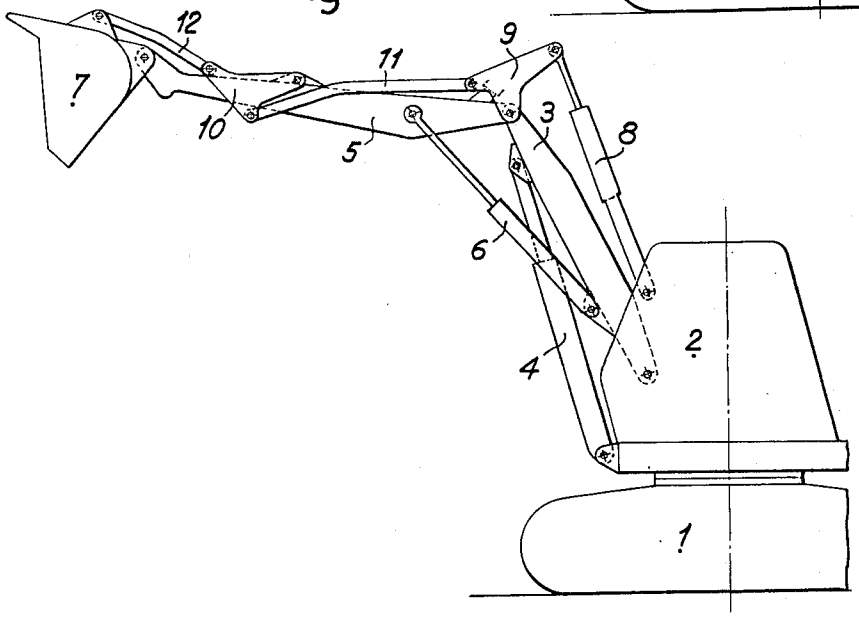


Fig.5.



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3,259,259

EASY CONTROL LOADER

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Claims priority, application France, Mar. 2, 1964, 965,747, Patent 1,395,675
3 Claims. (Cl. 214—138)

Self-powered loaders are already known which are mounted preferably on a swivelling platform or turntable carried by a crawler-mounted truck or undercarriage comprising a boom pivoted to the platform and adapted to be luffed or derricked by means of a first hydraulic cylinder bearing on the platform, an arm pivoted to the boom and adapted to be swung in relation to the boom by another hydraulic cylinder reacting on the boom, and a dipper pivoted at the outer end of the arm and responsive to a third hydraulic cylinder.

In certain types of loaders pertaining to this general arrangement it is possible to operate two or more hydraulic cylinders simultaneously in order to load the dipper by driving same horizontally on the ground with a constant orientation towards the front of the machine. Under these conditions, the dipper can only be filled by driving the complete machine forwards, which constitutes an additional operation and is attended by considerable wear and tear of the crawlers.

In other known designs this drawback is avoided and the bucket is filled by operating one or a plurality of hydraulic cylinders.

In loaders of these last-mentioned designs the cycle of operation comprises the following five steps:

(a) Loading step, by moving horizontally in the forward direction of the machine the dipper kept in its filling direction.

(b) Dipper righting step, in which the dipper is lifted backwards to enable same to preserve its load properly during the subsequent movements.

(c) Dipper elevating step, in which the dipper is kept in its loaded position.

(d) Dipper dumping step, obtained by dumping the dipper forwards, that is, in the direction opposite to (b).

(e) Dipper restoring step, in which the dipper is restored to its operative position on the ground and directed in its filling position close to the front of the vehicle.

However, in all hitherto known loaders the whole or at least some of these five steps described hereinabove require a simultaneous and timed control of two or all of the three hydraulic cylinders involved. Under these conditions, it is clear that these loaders can only be operated by a skilled driver, for his work requiring a considerable degree of attention is very tiresome.

It is the object of this invention to provide a loader of the type broadly set forth hereinabove, wherein each one of the five steps is controlled by means of a single hydraulic cylinder or like actuator, whereby the loader can be operated by any drivers, even unskilled ones.

In the loader according to this invention the third hydraulic cylinder or like actuator controlling the dipper is a double-acting cylinder having its bearing end pivoted on the platform and its operating end pivoted on a first bell-crank lever pivoted on the pivot pin interconnecting the dipper arm on the boom, said bell-crank lever being connected in turn by a link to a second bell-crank lever pivoted in turn on said arm and connected through another link to one point of said dipper, the first cylinder which controls said boom being a single-acting cylinder adapted to control the luffing motion of said boom and provided with valve means for retarding or braking the downward movements of said boom.

The details and relative dimensions of the assembly controlling the dipper movements, which include the aforesaid third hydraulic cylinder, said first and second bell-crank levers and said pair of links arranged according to the general disposal set forth in the preceding paragraph, can be calculated by the manufacturer without difficulty with a view to obtain a very approached dipper orientation in relation to the vertical during the locking of the third cylinder in step (a) as well as in step (c) of the cycle of operation.

Under these conditions, the five steps take place as follows:

(a) With the first cylinder inoperative and the third cylinder in the position laying the dipper flat on the ground, the second cylinder is pushed home in its expanded direction.

(b) The third cylinder is pulled home, i.e. in the dipper raising direction.

(c) The first cylinder is pushed home in the expanded direction, i.e. in the boom raising or luffing direction.

(d) The third cylinder is pushed home, i.e. to its expanded condition which causes the dipper to be dumped.

(e) The second cylinder is pulled home in the direction to contract same and the first cylinder is set in its inoperative position.

The various features and advantages of this invention will appear more clearly from the following description given by way of example with reference to the accompanying drawings showing diagrammatically in side elevational view a typical form of embodiment of a loader constructed according to the teachings of this invention.

In the drawings:

FIGURE 1 shows the beginning of step (a);
FIGURE 2 shows the end of step (a);
FIGURE 3 shows the end of step (b);
FIGURE 4 shows the end of step (c);
FIGURE 5 shows the end of step (d).

The loader shown in the drawings comprises as already known a self-powered, crawler-mounted undercarriage **1**, a platform or turntable **2** adapted to swing through a full circle on the undercarriage **1**, a boom **3** pivoted to the platform, a first hydraulic cylinder **4** bearing on the platform for controlling the boom luffing movements in relation to said platform, an arm **5** pivoted to the outer end of said boom, a second hydraulic cylinder **6** bearing on said boom to control the arm movements in relation to said boom, a dipper **7** pivoted at the end of said arm and a third hydraulic cylinder **8** for controlling the dipper.

According to this invention, the third cylinder **8** controlling the dipper is a double-acting cylinder having its bearing end pivoted to the platform **2**, and its operating end pivoted to a bell-crank lever **9** pivoted in turn to the pivot pin for mounting said arm on said boom, said lever **9** being connected through a link **11** to another bell-crank lever **10** pivoted to one point of said arm and connected in turn by means of another link **12** to one point of said dipper **7**.

The first cylinder **4** controlling the boom is a single-acting cylinder having a single chamber filled with hydraulic fluid and provided with a compressed hydraulic fluid inlet valve and an exhaust valve. The opening of the inlet valve causes the cylinder expansion, thus controlling the boom luffing (upward) movement. When this inlet valve is closed and the boom is thus held against motion, its downward movement takes place by gravity by opening the exhaust valve. To retard and regularize this downward movement, this exhaust valve is either a loaded valve or a valve formed with a calibrated orifice to constitute a braking (throttling) valve.

The second cylinder **6** controlling the arm is pivoted at a boom point located in vicinity of said platform **2** and is a single-acting cylinder.

The operation of this loader comprises the following five steps:

(a) During the dipper loading movement (FIGURE 1 to FIGURE 2) obtained by operating the second cylinder **6** alone, the front face of the dipper **7** is kept in its horizontal position (with an approximation of 2 or 3 degrees). Thus, the dipper is loaded without producing the translation of the carrier vehicle, thus sparing one operation and extending the useful life of the crawlers.

(b) After having rightened the dipper backwards by operating the third cylinder **8** pulled home, the front face of the dipper assumes an inclination of about 40° with respect to the ground, as shown in FIGURE 3.

(c) The third cylinder **8** remaining locked as well as the second cylinder **6**, the operator controls the first cylinder **4** to lift the load. The action produced by the links and bell-crank levers *without any control action from the operator of the loader* will slightly increase the inclination of the rear face of the dipper in its load-carrying position, whereby the front face of the dipper will extend at substantially 45 degrees to the horizontal, as shown in FIGURE 4.

(d) At this time the operator operates only the third cylinder **8** *to expand same home* so as to tilt the dipper forwards and dump the contents thereof as shown in FIGURE 5.

(e) To lower the assembly, the operator controls *only* the second cylinder **6** to retract the piston thereof *to its innermost position,* the third cylinder **8** remaining *locked* in its fully expanded position while the first cylinder **4** allows the boom to be lowered by gravity, this downward movement being retarded by the provision of the aforesaid throttling valve. During this downward movement the automatic movements of the links and bell-crank levers are sufficient to restore the dipper **7** exactly to its initial position, with the front face horizontal and laid flat on the ground. This is due notably to the fact that the cylinder **8** expanded home during this movement has one end pivoted to the platform **2**. Thus, the assembly has resumed the initial position of FIGURE 1 and is ready to perform another cycle of operations.

From the above detailed description it is obvious that the task of the operator of a loader of this type is greatly simplified in comparison with that of the driver of a known loader. No combined cylinder actions are required. Only one cylinder is operated during each step. Moreover, when the operator actuates a cylinder, he moves its piston *home*, or to its maximum permissible stroke, without requiring any particular skill or inherent experience for adjusting the amplitude of the control movement to be performed.

Due to the particularly simplified set of controls of the loader described hereinabove the machine can be operated by any drivers, even inexperienced ones.

What I claim is:

1. A loader comprising a platform, a boom pivoted to said platform, a first hydraulic cylinder pivotally mounted on said platform and controlling the luffing movements of said boom, an arm pivotally connected to said boom, a second hydraulic cylinder pivoted to said boom and controlling the arm movements, a bucket pivotally mounted to the outer end of said arm, a third hydraulic cylinder having a bearing end pivoted to said platform and a working end, a first bell-crank lever fulcrumed on the pivotal connection between said boom and said arm, a first link having a bearing end and a working end, said first bell-crank lever connecting the working end of said third cylinder to the bearing end of said first link, a second bell-crank lever pivotally mounted on said arm between said pivotal connection of said arm on the boom and the end of said arm, a second link having a working end connected to said bucket and a bearing end, said second bell-crank lever connecting the working end of said first link to the bearing end of said second link.

2. A loader as set forth in claim **1**, wherein said first hydraulic cylinder is a single-acting cylinder comprising a retarding exhaust valve, and said second and third hydraulic cylinders are double-acting cylinders.

3. A loader as set forth in claim **1**, comprising in addition a self-powered crawler-mounted undercarriage on which said platform is mounted for full swinging movement.

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HUGO O. SCHULZ, *Primary Examiner.*